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Express Mail No.: **EL492057225US** Date: **September 5, 2000**

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ANTONELLA FUSILLO
(Name of person mailing paper or fee)

SEP 05 2000

(Signature)

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		Attorney's Docket No: PRZYTULLA-12
INTERNATIONAL APPLICATION NO. PCT/EP99/01398	INTERNATIONAL FILING DATE March 4, 1999	PRIORITY DATE CLAIMED March 5, 1998

TITLE OF INVENTION
EXTRUSION HEAD

APPLICANT(S) FOR DO/EO/US
DIETMAR PRZYTULLA & PETER LANGOS

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.

2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.

3. [X] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. [ ] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)

6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.

8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. [X] Original or facsimile of an oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. concern other document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. [X] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. [X] A **FIRST** preliminary amendment.
    [ ] A **SECOND** or **SUBSEQUENT** preliminary amendment.

14. [ ] A substitute specification.

15. [ ] A change of power of attorney and/or address letter.

16. [ ] Other items or information:

533 Rec'd PCT/PTO 05 SEP 2000

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NO.
09/623773	PCT/EP99/01398	PRZYTULLA-12

17. [X] The following fees are submitted : BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5)):	
[X] For filing with EPO or JPO search report (37 C.F.R. 1.492(a)(5)) $ 840.00	$840.00
[ ] International preliminary examination fee paid to USPTO (37 C.F.R. 1.492(a)(1)) $ 670.00	
[ ] No international preliminary examination fee paid to USPTO (37 C.F.R. 1.492(a)(2)) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)) $ 760.00	
[ ] Neither international preliminary examination fee paid to USPTO (37 C.F.R. 1.492(a)(3)) nor international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)) $ 970.00	
[ ] International preliminary examination fee paid to USPTO (37 C.F.R. 1.492(a)(4)) and all claims satisfied provisions of PCT Articles 33(2)-33(4) $ 96.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	

Claims	Number Field	Rate	
Total Claims	12-20	x $ 18.00	
Independent Claims	1-3	x $ 78.00	
Multiple dependent claims (if applicable)		x $260.00	
		TOTAL OF ABOVE CALCULATIONS	$840.00
Reduction by 1/2 for filing by small entity, if applicable. Verified small entity statement must also be filed. (Note 37 CFR 1.9,1.27,1.28)			
		SUBTOTAL	$840.00
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date 37 CFR 1.492(f).			
		TOTAL NATIONAL FEE	$840.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +			$ 40.00
		TOTAL FEES ENCLOSED	$880.00
		Amount to be refunded	
		charged	

a. [X] A check in the amount of **$880.00** to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. **06-0502** in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **06-0502**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status.

Send all correspondence to:

HENRY M. FEIEREISEN
350 Fifth Avenue
Suite 3220
New York, N.Y. 10118
(212) 244-5500
Date: September 5, 2000

HENRY M. FEIEREISEN
Registration No. 31,084

 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No.: PRZYTULLA-12

In re Application of:	)
DIETMAR PRZYTULLA & PETER LANGOS	)
Int. Appl. No.: PCT/EP99/01398	)
Int. Filing Date: March 4, 1999	)
For: EXTRUSION HEAD	)

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Express Mail mailing label number: **EL492057225US**
Date of Deposit: **September 5, 2000**
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ANTONELLA FUSILLO
(Name of person mailing paper or fee)

(Signature)

S I R:

Preliminary to the first Official Action in the above-entitled application, please amend the application as follows:

IN THE SPECIFICATION:

Page 1, line 2, add the heading --BACKGROUND OF THE INVENTION--.

Page 3, line 3, add the heading --SUMMARY OF THE INVENTION--.

Page 5, line 20, add the heading --BRIEF DESCRIPTION OF THE DRAWING--.

Page 7, line 11, add the heading --DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS--.

Page 19, delete completely.

Page 20, after the heading "CLAIMS" and before the first claim add --What is claimed is:--.

IN THE CLAIMS:

Amend the following claims:

Claim 3, line 1, delete "or 2".

Claim 4, line 1, delete "2 or 3,".

Claim 6, line 1, change " one of the preceding claims 1 to 5" to --claim 1--.

Claim 7, line 1, change " one of the preceding claims 1 through 6" to --claim 1--.

Claim 9, line 1, change " one of the preceding claims 1 to 8" to --claim 1--.

Claim 11, line 1, change " one of the preceding claims 1 to 10" to --claim 1--.

REMARKS

This Amendment is submitted preliminary to the issuance of an Office Action in the present application.

Applicant has amended original claims 3, 4, 6, 7, 9, 11 to remove any multiple dependency. In addition, applicant has amended the specification to present it with proper headings.

When the Examiner takes this application up for action, it is requested to take the foregoing into account.

The Commissioner is hereby authorized to charge fees which may be required, or credit any overpayment to Deposit Account No. 06-0502.

Respectfully submitted,

By: _____
Henry M. Feiereisen
Agent for Applicant
Reg. No. 31,084

Date: September 5, 2000
350 Fifth Avenue
Suite 3220
New York, N.Y. 10118
(212) 244-5500
HMF:af

EXTRUSION HEAD

The invention relates to an extrusion head for producing a tubular parison for the manufacture of blow-molded plastic hollow bodies, including an adjustable ring-shaped tube outlet nozzle with annular nozzle/mandrel gap adjustment elements which permit a targeted adjustment of the nozzle gap for varying the wall thickness of the exiting parison.

Typical examples of such blow-molded parts of thermoplastics, in which customarily a targeted wall thickness adjustment is carried out in longitudinal direction of the tube and in circumferential direction of the tube, include large-volume containers such as, for example, canisters, lidded drums, bung drums or inner receptacles for pallet containers. During ejection of the tubular parison used for such blow-molded parts, the wall thickness of the tube is so adjusted by a rotation-symmetrical nozzle/mandrel gap control mechanism in longitudinal direction of the tube that the wall is slightly thinner toward the lower end and slightly thicker toward the upper end in direction of the discharge valve, because the tube as a consequence of its own weight lengthens by itself when suspended to thereby automatically realize an even axial wall thickness. Superimposed thereto is a partial wall thickness control in circumferential direction which is realized by a double nozzle/mandrel gap control mechanism in the tube in those tube zones which are provided in the blow-molded hollow body for the head and

bottom areas at greatly varying degrees of elongation - particularly in the areas which are offset by 90° to the partition plane of the blow mold halves.

With double nozzle/mandrel gap control mechanisms (= two control choices) known heretofore, the wall thickness of such blow molded parts can be controlled over their length with respect to:

- uniform radial wall thickness
- radial and circumferential wall thickness
- radial wall thickness with axially extending thick and thin areas, and
- partial longitudinal thick/thin areas.

Various constructions of extrusion heads are known for such tube adjustments by means of nozzle/mandrel gap control, for example from German Pat. No. 26 54 001, U.S. Pat. No. 3,114,932 or U.S. Pat. No. 1,107,628. Although for standard applications, simple conventional or the double nozzle control mechanisms suffice, they lack the capacity to carry out additional influences of the wall thickness. A simple extrusion head is further disclosed in British patent specification 1,107,628 for producing teeth or ribs in the extruded tube for bottles blow-molded from thermoplastic material. By means of V-shaped grooves and teeth formed in the ejector die, the blown bottles should receive in particular a decorative look. The central mandrel can be adjusted axially so that the ejected tube may or may not be acted upon by the teeth. A further adjusting option or

possible influence to permit a targeted wall thickness adjustment is, however, not possible.

It is an object of the present invention to obviate the mentioned drawbacks of the prior art and to improve the extrusion head of the type as described above with a double nozzle/mandrel gap control so as to permit a further additional superimposed wall thickness adjustment of the ejected tube for large-volume plastic containers such as 220 liters drums and - particularly also for asymmetric technical parts such as e.g. plastic fuel tanks (KKB) or for special applications in large cylindrical blow molded parts.

This object is attained in accordance with the invention by providing at least three separate nozzle/mandrel gap adjustment elements (D 0 = mandrel, DS I, DS II, DS III) which are separately controlled, differently profiled, and adjustable, and which individually or/and simultaneously can be brought into active engagement in the nozzle gap with the exiting parison from inside and outside.

Since the tube outlet nozzle is equipped with a triple nozzle/mandrel gap control mechanism, special thick areas can be so adjusted at particular locations of the tube depending on the blow molded hollow body in dependence on the configuration of the third nozzle/mandrel gap adjustment element, or further adjustment elements and on the duration of the intervention or impact on the

extruded parison, that the final blow molded hollow body exhibits only in the desired wall regions different or thicker wall thickness in comparison to the minimum wall strength of the typical wall.

A canister can, for example, be provided with stiffening ribs only at the vertical corner areas. In a KKB, the walls can also be made specifically thicker and thus more stable, e.g. in the side areas of the top bottom or at those areas at which connection stubs of fuel pipes are blow-molded thereon, or measuring instruments for a fuel tank level gauge are to be installed. In bung drums or lidded drums, it is possible to adjust a ribbed wall construction with uniform thick-thin distribution only in the vertical wall areas through a targeted material redistribution while, for example, maintaining the existing drum weight, thereby measurably improving the stiffness of the container, and in particular, the stacking strength when charged with hot contents. This is especially of particular importance in connection with large-volume drums (220 liters). Remarkably, the steps for quality improvement of the blow-molded hollow plastic body are realized exclusively on the exiting parison itself and not through constructive redesign of the blow mold.

As shown by way of example only, the novel triple or multi-nozzle/mandrel gap adjustment elements according to the novel invention results advantageously in a variety of new possibilities of application for large-volume blow-molded plastic parts of all types (e.g. automobile accessories or the like).

Compared to a conventional extrusion head with heretofore dual nozzle/mandrel gap adjustment elements, the provision of an extrusion head with the novel triple nozzle/mandrel gap adjustment elements according to the invention can be realized comparably inexpensively and does not require any investment in machines. The adjustment elements are moved only over very short distances, and only simple control motors are sufficient, and no deformation of the adjustment elements is experienced.

The process according to the invention for producing blow-molded hollow plastic bodies by a blow mold machine with extruder, extrusion head with circumferential distributor and respective blow mold, and carrying out a particular adjustment of the wall thickness of the exiting parison during ejection of the tubular parison from the extrusion head through adjustment of the nozzle/mandrel gap, is characterized in particular by realizing a random, circumferentially varying thick-thin adjustment of the tubular parison through a sequential or simultaneous impact of three differently profiled, separately adjustable nozzle/mandrel gap adjustment elements. This multiple adjusting capability of the tube for large-volume drums is unique and results in a quality of the drums that has been unattainable to date.

The invention will now be explained and described in more detail by way of exemplified embodiments illustrated only schematically in the drawings, in which:

FIG. 1 shows a partially sectional illustration of an extrusion head according to the invention;

FIGS. 2 to 6 show the extrusion head according to FIG. 1 with different operational positions of the adjustment elements;

FIGS. 7 to 9 show a modified embodiment of an extrusion head with different operational positions of the nozzle/mandrel gap adjustment elements;

FIG. 10 shows a further modified embodiment of an extrusion head;

FIG. 11 shows a fourth modified embodiment of an extrusion head;

FIGS. 12 to 15 show a fifth modified embodiment of an extrusion head with different operational positions of the nozzle/mandrel gap adjustment elements;

FIG. 16 shows a lidded drum as blow-molded hollow body;

FIG. 17 shows a fassett (canister of upright size) as blow-molded hollow body;

FIG. 18 shows a canister (jerrican) as blow-molded hollow body;

FIG. 19 shows a tubular parison with cross sections; and

FIG. 20 shows a cross sectional illustration of a schematically illustrated plastic fuel tank (KKB).

FIG. 1 shows an extrusion head 10 with fragmentary illustration of three adjustable nozzle/mandrel gap adjustment elements D 0, DS I and DS II in the basic position "nozzle gap closed". Arranged centrally in the extrusion head 10 is an axially adjustable mandrel holder 12 with an underside which has secured thereon an easily detachable and exchangeable truncated cone shaped mandrel 14 as first nozzle/mandrel gap adjustment element Dzero (= D 0). To the outside, the extrusion head is enclosed by a housing 16. Accommodated in the housing 16 is a hollow cylindrical storage space 18 in which the molten plastic material fed from one or several extruders has been circumferentially distributed. The storage space 18 ends in a circular ring-shaped nozzle gap 20 which is demarcated on the inside by the mandrel 14, and the first nozzle/mandrel gap adjustment element D 0 and on the outside by a stationary nozzle ring part DF

and two adjustable nozzle/mandrel gap adjustment elements, namely the nozzle slide 1 = DS I and the nozzle slide 2= DS II. Like the adjustable mandrel 14, also the axially adjustable adjustment elements DS I and DS II are secured to the extrusion housing for easy detachment and exchange. The axial adjustment and exact positioning of the adjustable nozzle/mandrel gap adjustment elements may be realized e.g. hydraulically or electromotorically. Furthermore, the housing-fixed nozzle ring part DF is likewise secured to the extrusion head in a manner that permits easy detachment and exchange.

This is of particular importance in order to realize during a product change or replacement of the subsequent blow mold also a rapid exchange of the ring parts and adjustment elements of the nozzle gap, which are suited to the product at hand and accordingly profiled.

In the extrusion head 10 shown in FIG. 1, all nozzle/mandrel gap adjustment elements are returned to their basic position "nozzle gap closed", i.e. the mandrel D 0 has traveled to the uppermost position, and the nozzle slide = adjustment elements DS I and DS II have traveled to the lowermost position. The respective lengths of path = adjustability of the adjustment elements, are indicated by the respective arrows. In the illustrated exemplified embodiment, the nozzle gap defining surfaces of the fixed nozzle ring part DF and the adjustment element DS I are profiled, and the nozzle gap defining surfaces of the

mandrel D 0 and of adjustment element DS II have smooth circumference, as further described with reference to the following Figures.

In FIG. 2, only the mandrel 14 is slightly moved downwards (see arrow). The nozzle gap 20 is demarcated at the outside by the lower inner circumferentially smooth edge 24 of the nozzle slide DS II, and at the inside by the mandrel 14. The discharged tube 22 is evenly thin about its circumference. In the partial section of the tube 22, as illustrated therebelow, a small arrow indicates the potential thickness of the tube when the mandrel travels to the lowermost position and the nozzle gap is fully open.

In FIG. 3, the adjustment element DS I together with the adjustment element DS II is slightly moved upwards (see arrow), so that these two adjustment elements are not in operative engagement at that point with the exiting tubular parison 22. The nozzle gap 20 is now demarcated by the mandrel 14 and the profiled housing-fixed ring part DF. The tube exiting the nozzle gap is no longer uniformly thick in circumferential direction, but is slightly thinner in two opposing regions than the respective tube regions respectively arranged offset by 90° thereto. Such a double-oval adjustment of the nozzle gap or oval wall thickness adjustment in areas of the tube is typical for blow molded parts with flat top plate and bottom plate, whereby, the two opposing tube sections 26 with greater wall thickness are so guided between the open blow mold halves that the horizontal container wall areas, which are offset by 90° to

the mold partition plane, are blow-molded therefrom with the greatest stretching degrees and blow paths of the plastic material. This feature thus serves as a measure to attain a uniform wall thickness in the finished container, so that the container wall is not thinner in the corner areas with high degrees of stretching or orientation in comparison to the remaining vertical wall parts. FIG. 3 illustrates a sectional view through the thinner tube area (and extrusion head) which bears in the blow mold in the mold partition plane upon the blow mold wall.

FIG. 4 shows the same position of the nozzle/mandrel gap adjustment elements compared to FIG. 3, but at a 90° rotated section through the extrusion head and thus through a thicker wall zone 26 of the tube 22, as clearly illustrated by the partial sectional view through tube 22 therebelow. To the left, next to the profiled ring part DF, there is indicated a developed view of the known wavy profile of the inner nozzle surface of the ring part DF.

In FIG. 5 and FIG. 6, the profiled nozzle slide DS I is moved downwards and acts on the exiting plastic tube, while the nozzle slide DS II still remains in its previous upper position outside a zone of influence. The profile of DS I includes a circumferential tooth profile, as clearly shown therebelow by the partial sectional illustrations of the exiting tube 22. The teeth 30 of the profile form a thinner tube wall thickness, and a greater tube wall thickness with outwardly projecting ribs is formed in the tooth gaps 32. FIG. 5 shows the section through the extrusion head and the tube 22 in the area of a thinner tube wall (tooth action 30), and FIG. 6

shows a slightly offset section in the area of a thicker tube wall (tooth gap action 32), with pronounced formation of longitudinal ribs 28. The profile in the fixed nozzle ring part DF, as well as in the nozzle slide DS may be expanded slantingly outwardly or simply parallel to the surface of the mandrel 14. FIG. 6 indicates by way of the small arrow below the nozzle guide DS II, the depth by which the teeth 30 of the tooth profile of the nozzle slide DS I are able to act on the tube 22 from outside. To the left of the nozzle slide DS I is a schematic illustration, in developed view, of the tooth profile of the DS I with teeth 30 and tooth gaps 32. In this embodiment, the lowermost non-profiled nozzle slide DS II, serves actually only as a smoothening element or to cover the profiles of the ring part DF or/and to cover the nozzle slide DS I.

FIG. 7, FIG. 8 and FIG. 9 illustrate a modified embodiment of an extrusion head according to the invention, with the special profile (= tooth profile) formed on the nozzle slide DS II instead of on the nozzle slide DS I, while the nozzle slide DS I has a smooth circumferential surface in direction of the nozzle gap. In FIG. 7, both nozzle slides DS I and DS II are moved into their uppermost position (outside of zone of influence), and only the oval- profile of the housing-fixed ring part DF and the adjustable mandrel 14 act on the tube 22 in the nozzle gap 20. The small partial sectional views on the side indicate on the left a thinner tube wall thickness (in mold partition plane FT) and on the right a thicker tube wall thickness (90° with respect to the mold partition plane FT). In FIG. 8, both nozzle slides DS I and DS II are moved downwards. The DS I has a lower smooth

circumference and covers the oval-profile of the fixed ring part DF, thereby rendering it ineffective. The tooth profile of the lower nozzle slide DS II acts in the nozzle gap 20 on the exiting tube 22 and produces the profiled tube formation with the longitudinal ribs 28, as illustrated in the small partial sectional illustration.

FIG. 9 shows a positioning of the adjustment elements in which no profile is effective, but rather only a circumferentially even change of the wall thickness can be carried out by an axial displacement of the mandrel 14. In accordance with the wall thickness diagrams a, b, and c, which illustrate for each adjustment element a separate control program, as shown in the lower left hand side of FIG. 9, the control of adjustment elements D 0, DS I and DS II for adjusting a desired wall thickness over the length L of the exiting tube is effected at the blow form machine. Diagram a shows - as does the partial sectional view to the right of the ejected tube 22- an even increase of the wall thickness from bottom to top, by opening the nozzle gap 20 through axial displacement of mandrel 14 in downward direction. The added wall thickness for the top plate and bottom plate of the drum, as shown in diagram b, is realized by the oval profile in the fixed nozzle ring part DF which is cleared when the non-profiled and smooth nozzle slide DS I travels upward. At that point, the tooth profile nozzle slide DS I is hereby not effective. For adjustment of the tooth profile in the tube - e.g. for longitudinal ribs in the vertical wall region of the bung drum as shown to the right thereof - the nozzle slide DS II is moved downwards for active engagement, whereby also the nozzle slide DS I moves downwards, thereby covering again

the profile of the fixed ring part DF. In order to maintain an even thickness of the tube, the mandrel 14 is also moved simultaneously slightly downwards, and the nozzle gap opened as needed. For clarification, it should be noted that the nozzle slide with the novel tooth profile of the nozzle slide realizes in general only a redistribution of the plastic material in the nozzle gap, whereby the free cross sectional area of the nozzle gap may remain constant.

Another embodiment of an extrusion head according to the invention is shown in FIG. 10, whereby no profiled housing-fixed ring part is provided and the nozzle slide DS I is also not profiled but exhibits a circumferentially smooth inner surface towards the nozzle gap 20. The known oval profile is formed in the nozzle slide DS II, with an exchangeable mandrel 34 having a special configuration. At its outer circumference, the mandrel 34 is provided in direction of the nozzle gap 20 with a plurality of ribs 14*, which are evenly spaced from one another in a star-shaped manner, and interposed grooves. Disposed at the lower end of the mandrel head 34 is the axially adjustable adjustment element D 0* which is provided exteriorly with correspondingly formed ribs extending upwardly and uniformly spaced from each other for precisely filling in flush engagement the grooves and intermediate spaces between the ribs 14*. When the star-shaped slide = adjustment element D 0* occupies its uppermost basic position, the ribs of star-shaped slide D 0* extend in the nozzle gap 20 flush with the ribs 14* of the mandrel 34, so that the interlocking ribs of the mandrel head 34 form a smooth conical surface in the nozzle gap. In contrast thereto, when the

star-shaped slide D 0* travels downwards, the intermediate spaces between the ribs and the grooves of the mandrel head 34 are cleared and the stationary ribs 14* act in the nozzle gap on the exiting tube 22, thereby forming a tooth profile in the inner surface of the tube in dependence on the geometry of the ribs 14*. An up and down movement of the smooth non-profiled nozzle slide DS I allows, in general, an even adjustment of the wall thickness, while the oval profile of the tube is effected by the respectively profiled nozzle slide DS II, whereby the nozzle slide DS II travels into a lower position, with the minimum wall thickness of the tube being adjusted by the nozzle slide DS I. Then, DS II remains in position, and DS I travels slightly upwards, whereby the oval profile in DS II is cleared, and the tube is formed with respectively thicker walls in the two diametrically opposing zones. This construction of the extrusion head permits a best possible superimposed action of the various adjustment elements upon the tube.

A further embodiment is shown in FIG. 11, illustrating a modification of the extrusion head shown in FIG. 6, with a ring sleeve as nozzle slide DS III being secured inside the nozzle head DS II for adjustment in circumferential direction. This ring sleeve = DS III has at its bottom side a same tooth profile as the nozzle slide DS I disposed on the inside. Additionally, the nozzle slide DS II is slightly slanted inwardly at the bottom. When downwardly moving the nozzle slide II together with ring sleeve DS III so as to be flush with the nozzle slide I, a rotation of the ring sleeve enables a covering or opening of the teeth of the nozzle slide DS I from the side. In this way, the formation of the rib width on the exiting

tube 22 can be continuously modified or randomly adjusted. A simultaneous up and down movement of the nozzle slide DS II together with the ring sleeve DS II also allows the height of the ribs 28 to be continuously modified and adjusted.

Finally, FIG. 12, FIG. 13, FIG. 14 and FIG. 15 show a further advantageously configured extrusion head. The even wall thickness about the circumference is adjusted with the adjustment elements D 0 = mandrel 14. A profiled housing-fixed ring sleeve is not provided; however, if needed, may be provided for installing a further special profile. The nozzle slide DS I has the tooth profile and is provided with a greater stroke of its adjustment drive. Furthermore, the nozzle slide DS II is provided with the oval profile and of split configuration i.e. it is made in this case of two 180° half ring parts which are guided and secured on the nozzle slide DS I for displacement in radial direction. In FIG. 12, all adjustment elements have traveled into the basic position "nozzle slide closed". In FIG. 13, the nozzle gap is opened, with mandrel 14 having traveled downwards. Likewise, the nozzle slide DS I together with DS II have traveled axially downwards, with the attached nozzle slide DS II acting with its oval profile in the nozzle gap 20 on the exiting tube. In FIG. 14, both half ring parts of the nozzle slide DS II have traveled radially outwards and are no longer in an active engagement. As shown in FIG. 15, the nozzle slide DS I is now slightly moved further downwards until its tooth profile or special profile is in active engagement. The advantage of this construction is the need for only a single lifting drive for the nozzle slides DS I and DS II. The short radial movement of the DS II - half rings

could be realized, for example, by an electric spindle motor or a respective small drive. This configuration is suited e.g. particularly for retrofitting existing extrusion heads.

The adjustment elements of all embodiments are basically attached to the extrusion head in an easily exchangeable manner. The nozzle slide with the tooth profile may certainly also be modified depending on the desired profile requirement of the hollow body to be blow-molded (cf. FIGS. 19, 20).

FIG. 16 illustrates a 220 liter lidded drum 36 having longitudinal ribs which are formed in the vertical wall zones and evenly spaced from one another but which do not extend into the bottom region, as shown in the sketched partial sectional illustration below with constant drum wall thickness.

Exemplified embodiment: A 220 l plastic drum (e.g. Vanguard lidded drum) with a drum body weight of approximately 7.5 kg has a largest diameter in the drum wall or foot ring of about 575 mm. The swelling parison exiting the nozzle gap has a diameter of about 270 mm with a wall thickness of about 12 to 25 mm. By means of the adjustment elements, the wall thickness of the tube can be adjusted partially or along sections in this thickness range or adjusted at even greater range. Hereby, the particular adjustment element D 0* is advantageously provided with a rectangular tooth profile, whereby the diameter of the adjustment element D 0* amounts to about 190 mm, and the inner and outer ring edges,

interacting with the ejected tube, have alternately about 60 grooves which are half-round as viewed in cross section, and a complementary number of rectangular teeth, with the width of the grooves being about 4 mm and the width of the teeth about 5 mm. The radial depth of the grooves is thereby about 10 mm. The configuration of the rectangular teeth is hereby of importance; a toothed engagement with pointed saw teeth is unsuitable for large-volume containers according to the invention with a diameter of about 585 mm and a weight of about 8 to 10 kg plastic material, because the extension of the thinner areas in circumferential direction of the drum body must be wider in any case than the thicker areas (= internal ribs) in the axial drum wall of the finished blow-molded hollow body.

FIG. 17 shows a fassett 38 in which only the vertical wall zones are reinforced by longitudinal ribs. This longitudinal ribbing is clearly illustrated in the partial sectional illustration through the container wall.

FIG. 18 shows a canister 40 formed only in the corner regions with two longitudinal ribs which extend, however, to the top plate and bottom plate, as indicated in the partial sectional view below. A longitudinal and cross-sectional view of a tubular parison 22 with special profile for a plastic fuel tank KKB 42 is shown in FIG. 19, with FIG. 20 showing flash pieces still attached thereto.

The extrusion head according to the invention with three separate adjustment systems is particularly suitable to fabricate and produce such special profiles with partial material accumulation (cf. section B-B in FIG. 19) as required for KKB 42 in the area of a stub opening (cf. section D-D in FIG. 20).

LIST OF REFERENCE NUMERALS

10	Extrusion head
12	Mandrel holder
14	Mandrel = D 0 (Dzero)
16	Extrusion head housing
18	Storage space
20	Nozzle gap
22	tubular parison
24	inner edge DS II
26	thicker tube zone
28	Ribs in 22
30	Tooth
32	Tooth gap
34	Mandrel head for 14*
36	Lidded drum (Vanguard FRH-drum)
38	Fasset®
40	Canister
42	Plastic fuel tank (KKB)

Nozzle/Mandrel Gap Adjustment Elements:

DF	fixed nozzle ring part
D 0	first adjustment element = mandrel 14
DS I	second adjustment element = nozzle slide 1
DS II	third adjustment element = nozzle slide 2
DS III	fourth adjustment element = rotatable ring sleeve
D 0*	star-shaped adjustment element on mandrel 14

CLAIMS

1. Extrusion head for producing a tubular parison for the manufacture of blow-molded plastic hollow bodies, including an adjustable ring-shaped tube outlet nozzle with annular nozzle/mandrel gap adjustment elements which permit a targeted adjustment of the nozzle gap for varying the wall thickness of the exiting parison, characterized in that at least three separate nozzle/mandrel gap adjustment elements (D 0 = mandrel, DS I, DS II, DS III) which are differently profiled and exchangeable, and which individually or/and simultaneously can be brought into active engagement in the nozzle gap with the exiting parison from inside and outside, wherein at least two of the adjustment elements (D 0 = mandrel, DS I, DS II, DS III) is hereby adjustable and respectively provided with an adjustment drive.

2. Extrusion head according to claim 1, characterized in that the third additional adjustment element (DS II) is provided for the adjustment of a special profile (e. g. tooth profile) below the adjustment element (DS I) and adapted for acting as last wall thickness influence on the exiting tube.

3. Extrusion head according to claim 1 or 2, characterized in that the lowermost inner edge of the third adjustment element (DS II), which can be brought into engagement with the exiting tube, is disposed at the same level or slightly above the lowermost outer edge of the central mandrel (D O).

4. Extrusion head according to claim 1, 2 or 3, characterized in that the third adjustment element (DS II) is provided with its own adjustment drive and is guided for movement and displacement in axial direction.

5. Extrusion head according to claim 4, characterized in that the adjustment elements (D 0, D 0*, DS I, DS II, DS III) are provided with a quick attachment and configured for easy exchange.

6. Extrusion head according to one of the preceding claims 1 to 5, characterized in that the third adjustment element (DS II) is of split configuration and made of two 180° half ring segments which are provided with a separate adjustment drive and guided for movement and displacement in radial direction.

7. Extrusion head according to one of the preceding claims 1 through 6, characterized in that there is provided between adjustment element (DS I) and adjustment element (DS II) a further adjustment element (DS III) which is adjustable, e.g. supported for rotation in circumferential direction

8. Extrusion head according to claim 7, characterized in that the adjustment element (DS III) has the same special profile (e.g. tooth profile) as the adjustment element (DS I).

9. Extrusion head according to one of the preceding claims 1 to 8, characterized in that the axially adjustable adjustment element D 0* supported on the mandrel holder (12) for axial displacement is provided with a special profile (e.g. tooth profile).

10. Extrusion head according to claim 9, characterized in that the adjustment element (D 0*) is provided with a special profile (e.g. tooth profile), that the adjustment element (DS I) is provided without profile and smooth throughout about its circumference, and that the adjustment element (DS II) is provided with an oval-profile known per se.

11. Extrusion head according to one of the preceding claims 1 to 10, characterized in that the adjustment element (D 0*) is provided with a rectangular tooth profile, wherein - for a 220 liters plastic drum (55 U.S. gallons) with an outer diameter of about 585 mm at drum weight of about 9.5 kg - the diameter of the adjustment element is about 190 mm and the inner and outer ring edges interacting with the ejected tube having alternately about 60 grooves of half-round configuration as viewed in cross section, and a complementary number of rectangular teeth, with the width of the grooves being narrower than the width of the teeth.

12. Extrusion head according to claim 11, characterized in that the with of the teeth is about 5mm, and the width of the grooves is about 4 mm, at a radial depth of the grooves of about 10 mm.

ABSTRACT

The invention relates to an extrusion head for producing a tubular parison (22) in order to manufacture large-volume, blow molded plastic hollow bodies. The inventive extrusion head has an adjustable ring-shaped tube outlet nozzle for selectively adjusting the nozzle opening (20) in order to alter the wall thickness of the exiting parison (22). In order to provide a multiple adjustability of the extruded tube cross section, the invention provides that the extrusion head comprises at least three separate nozzle/mandrel gap adjustment elements (D 0 = mandrel, DS I, DS II, DS III) which are differently profiled and exchangeable. The elements can be individually and/or simultaneously brought into working contact with the exiting parison (22) in the mandrel gap (20) from inside and/or outside, whereby at least two of the adjustment elements (D 0 = mandrel, DS I, DS II, DS III) are configured such that they can be adjusted. To this end, the at least two adjustment elements are each equipped with a corresponding adjusting drive.

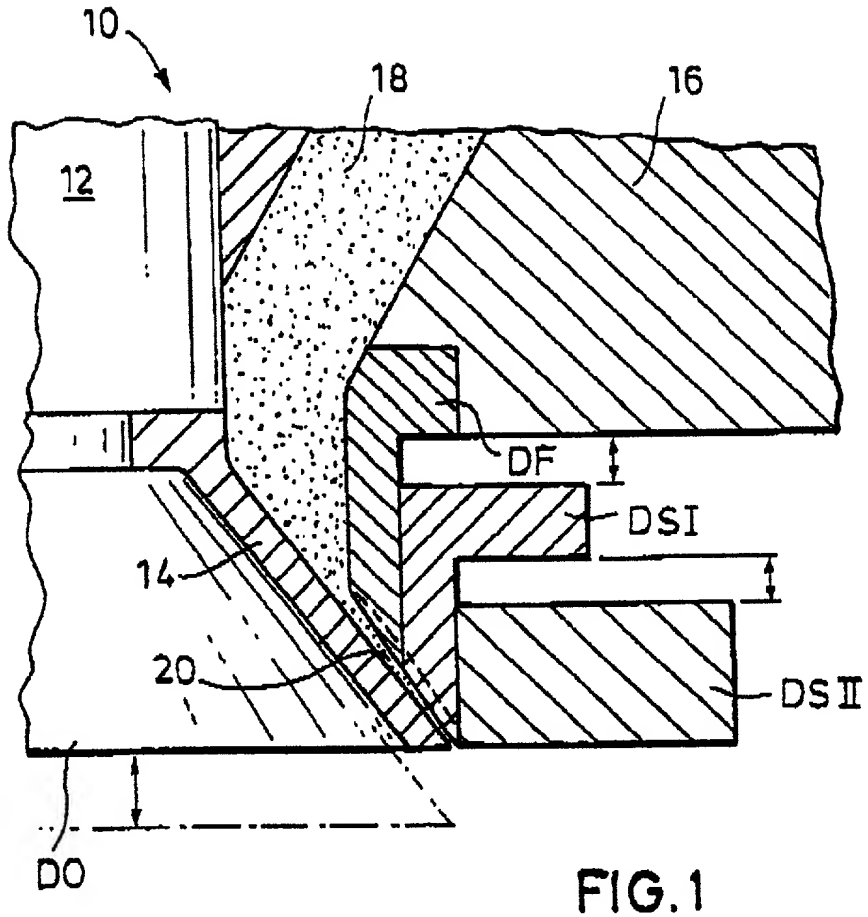


FIG.1

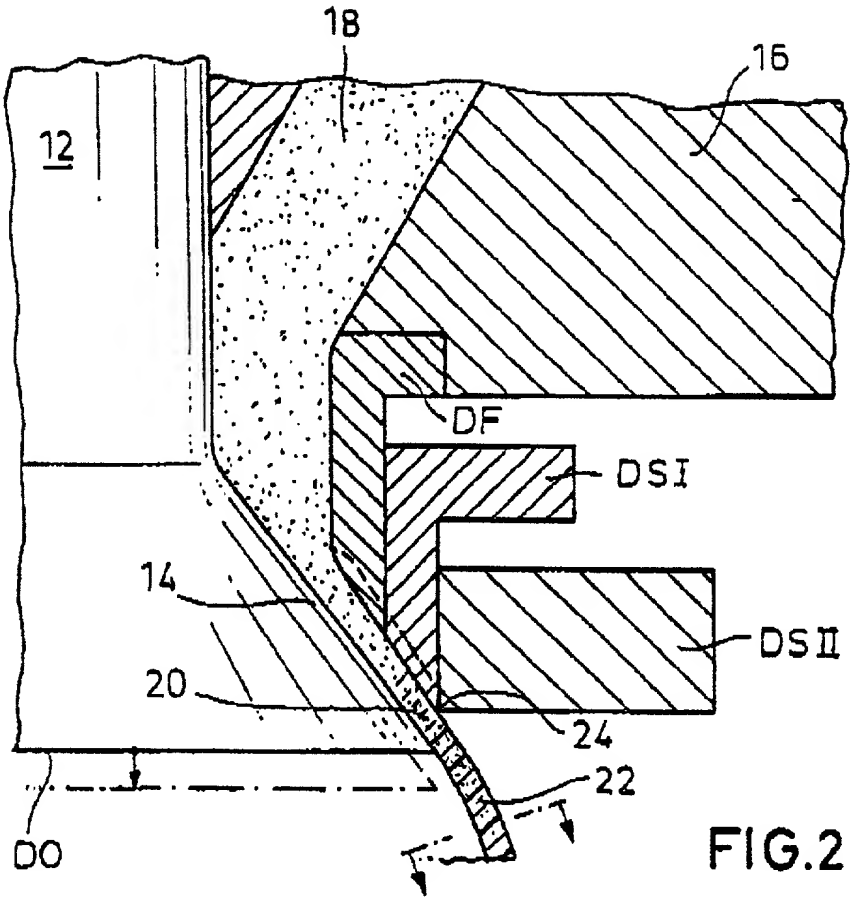


FIG.2

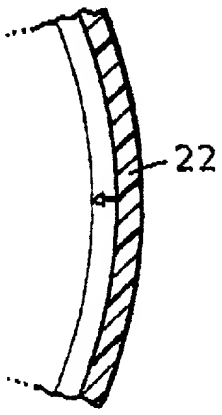


FIG.2a

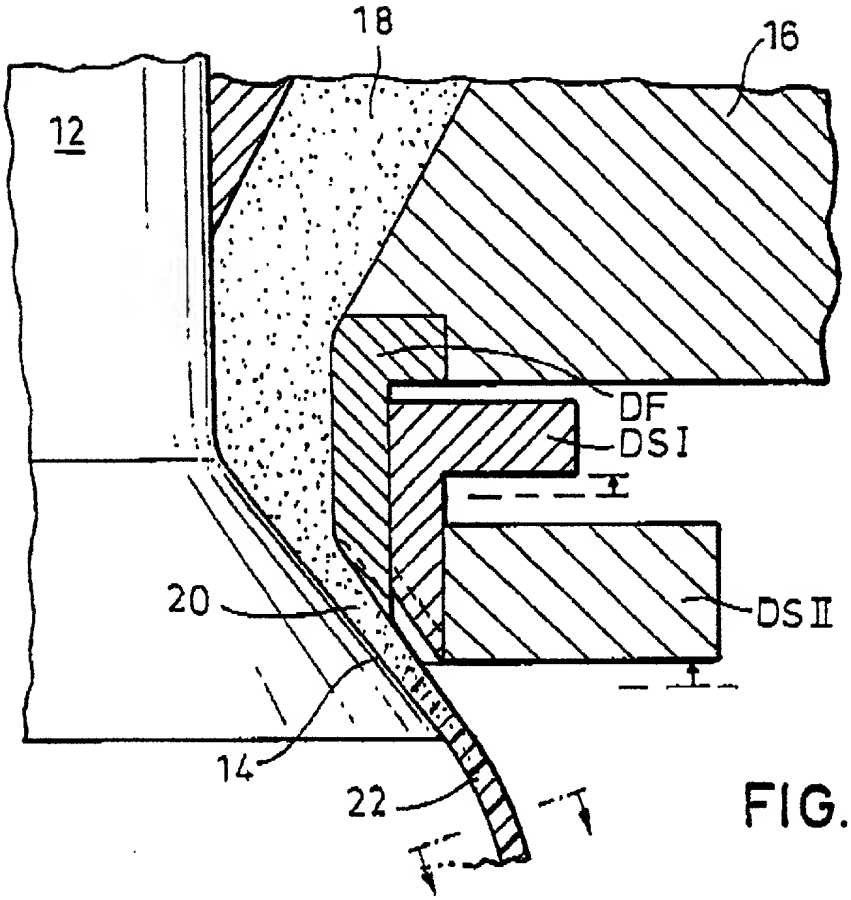


FIG.3

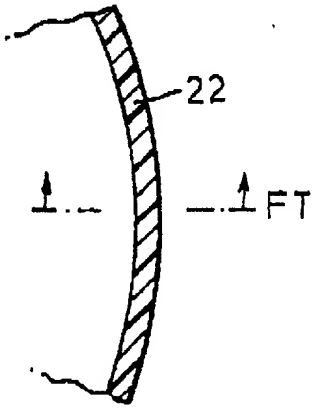


FIG.3a

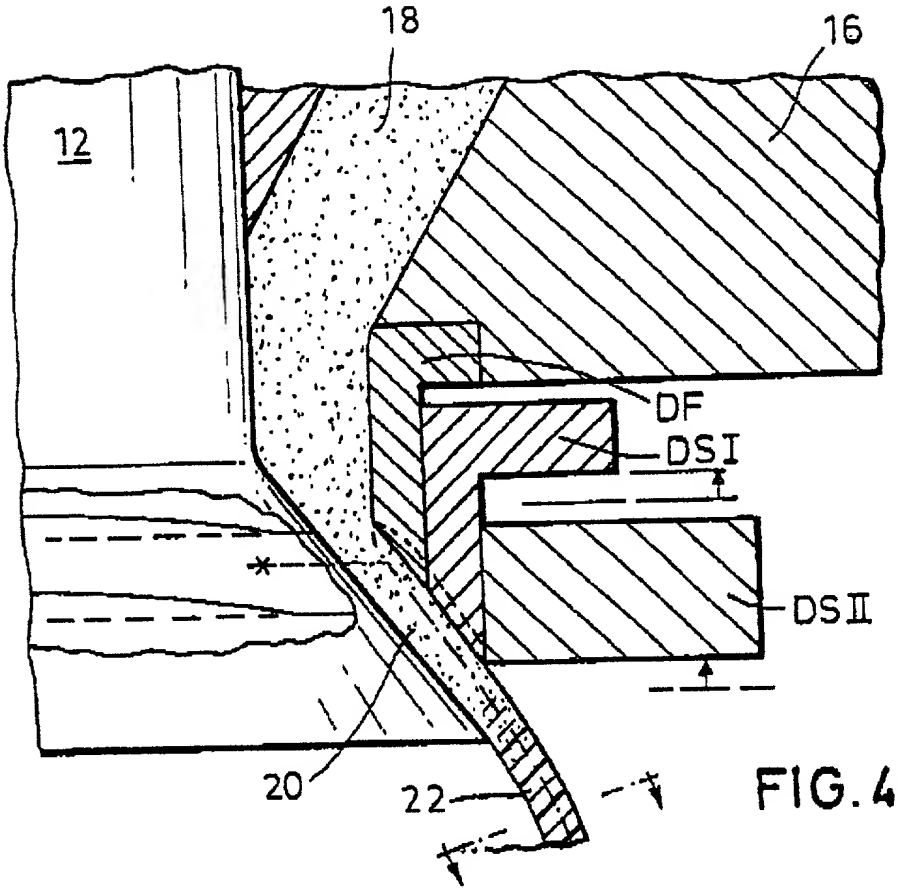


FIG. 4

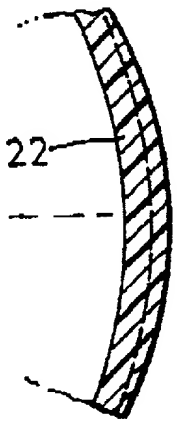


FIG. 4a

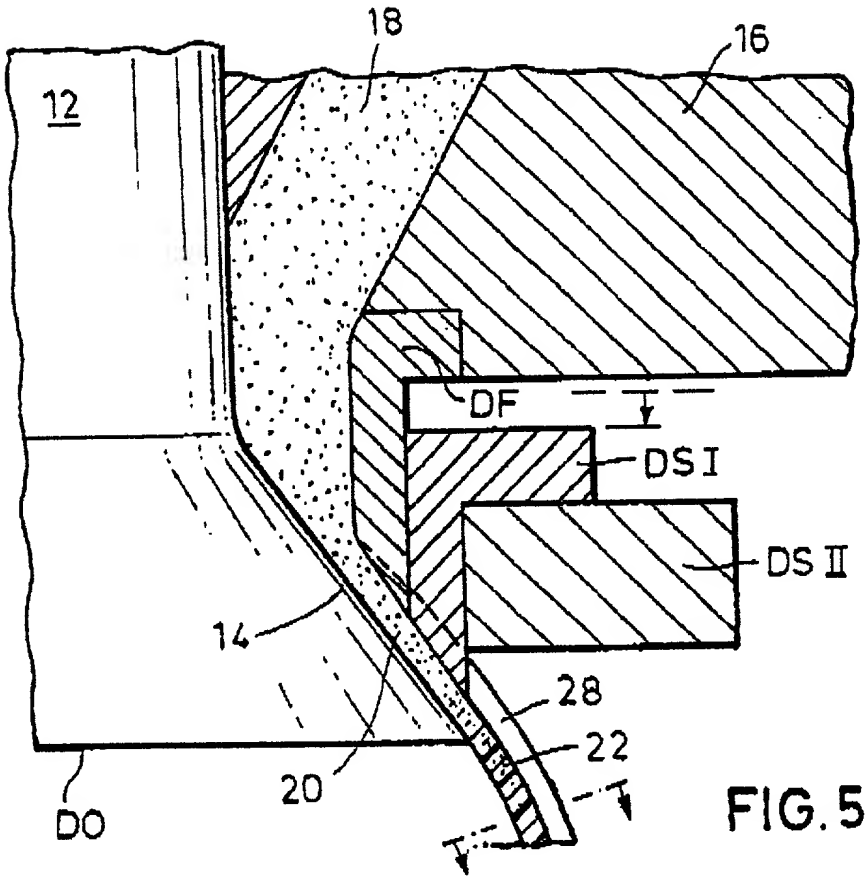


FIG. 5

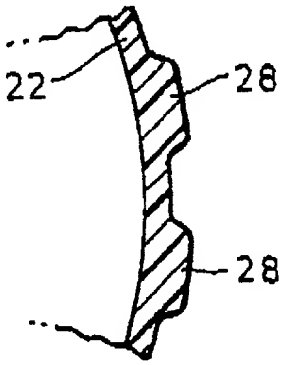


FIG. 5a

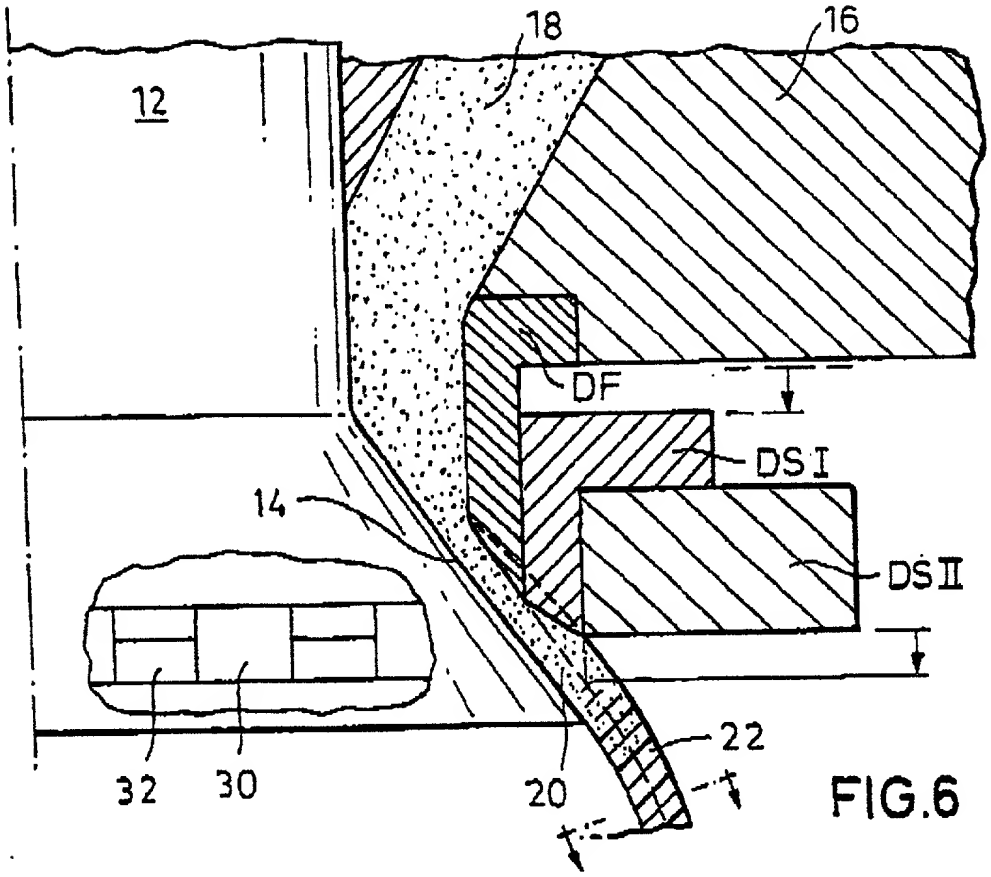
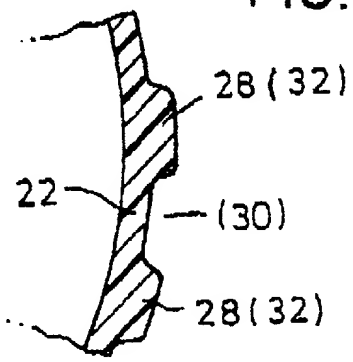


FIG.6

FIG.6 a



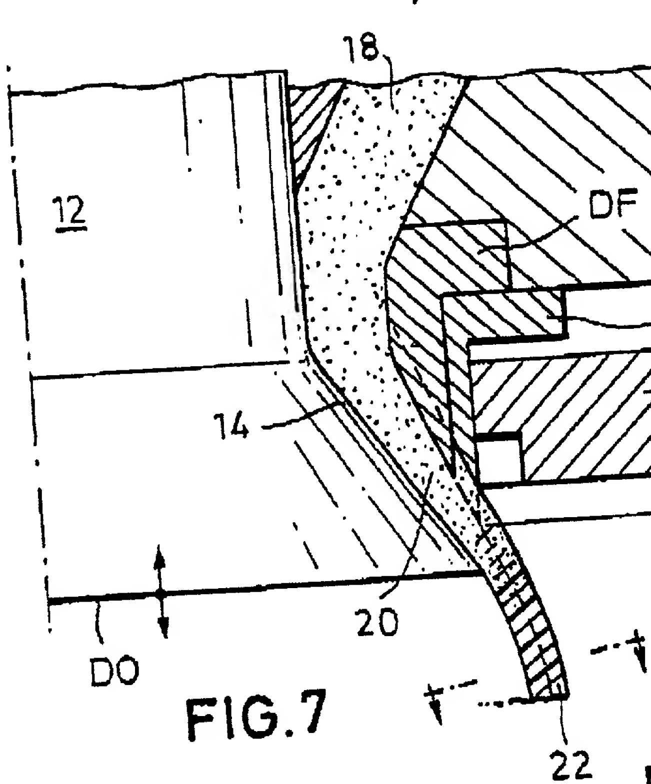


FIG.7

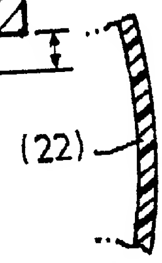


FIG.7a

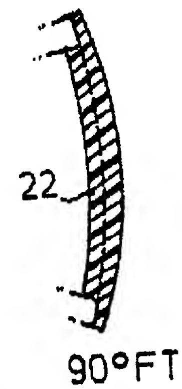


FIG.7b

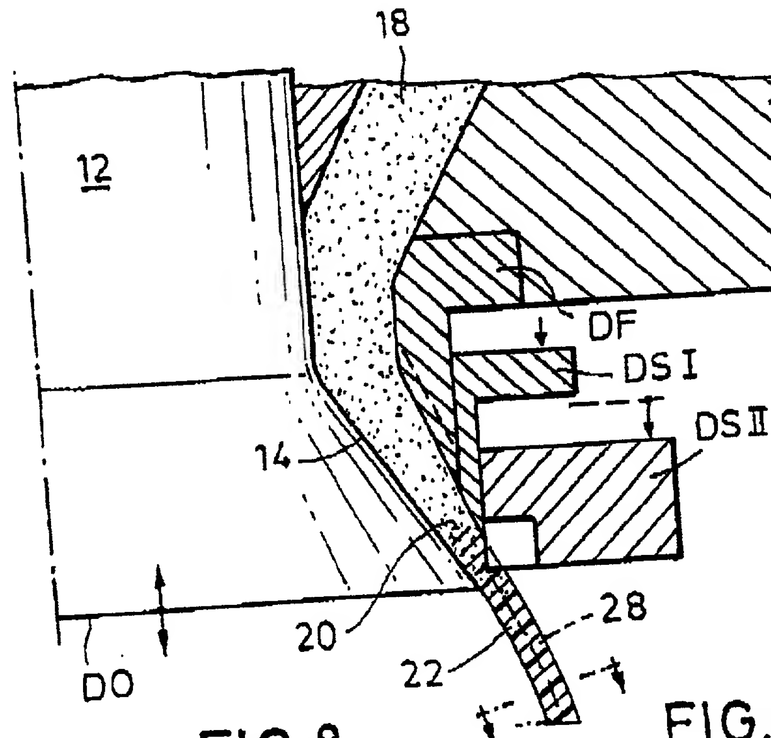


FIG.8

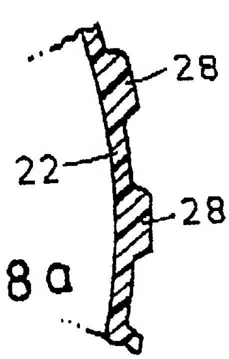


FIG.8a

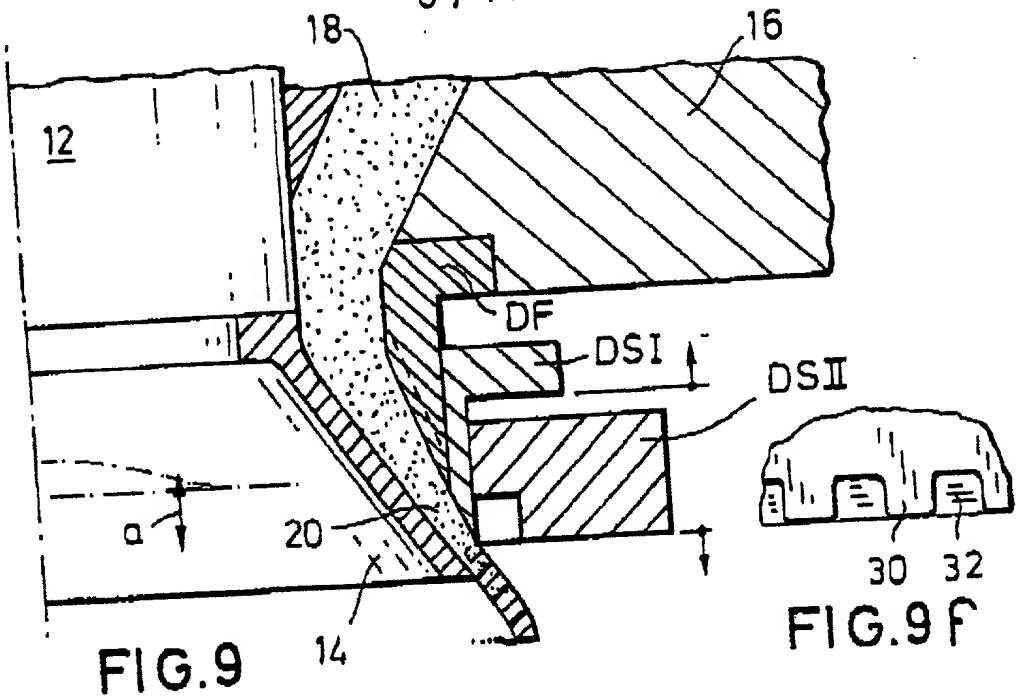


FIG.9

FIG.9f

FIG.9a

FIG.9b

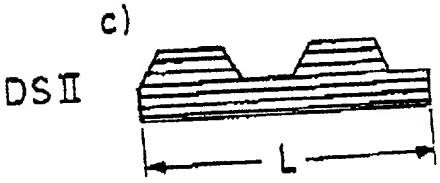


FIG.9c

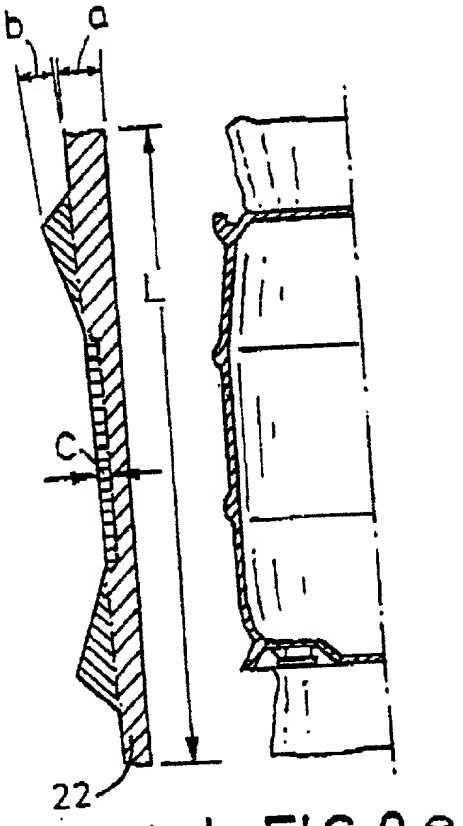


FIG.9d

FIG.9e

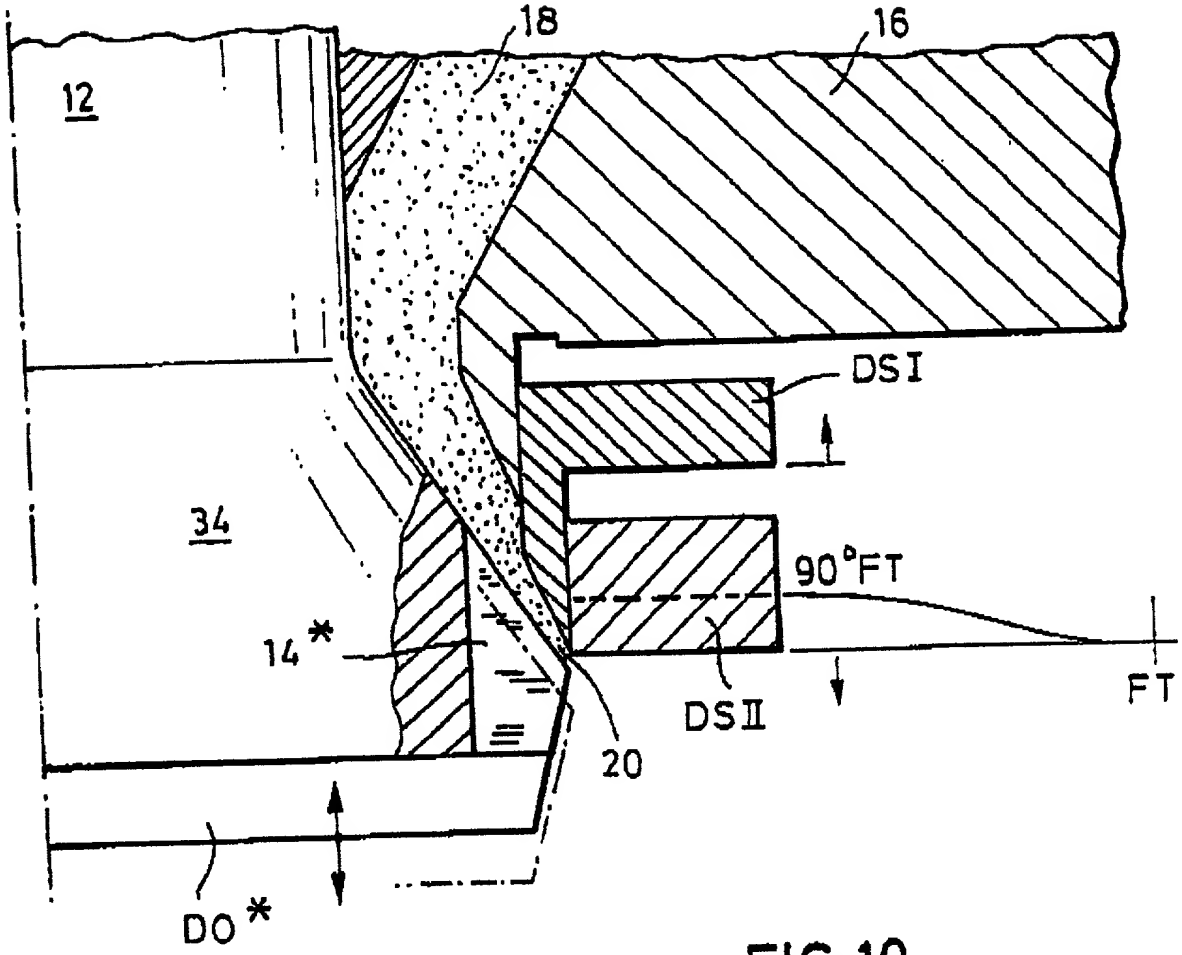


FIG.10

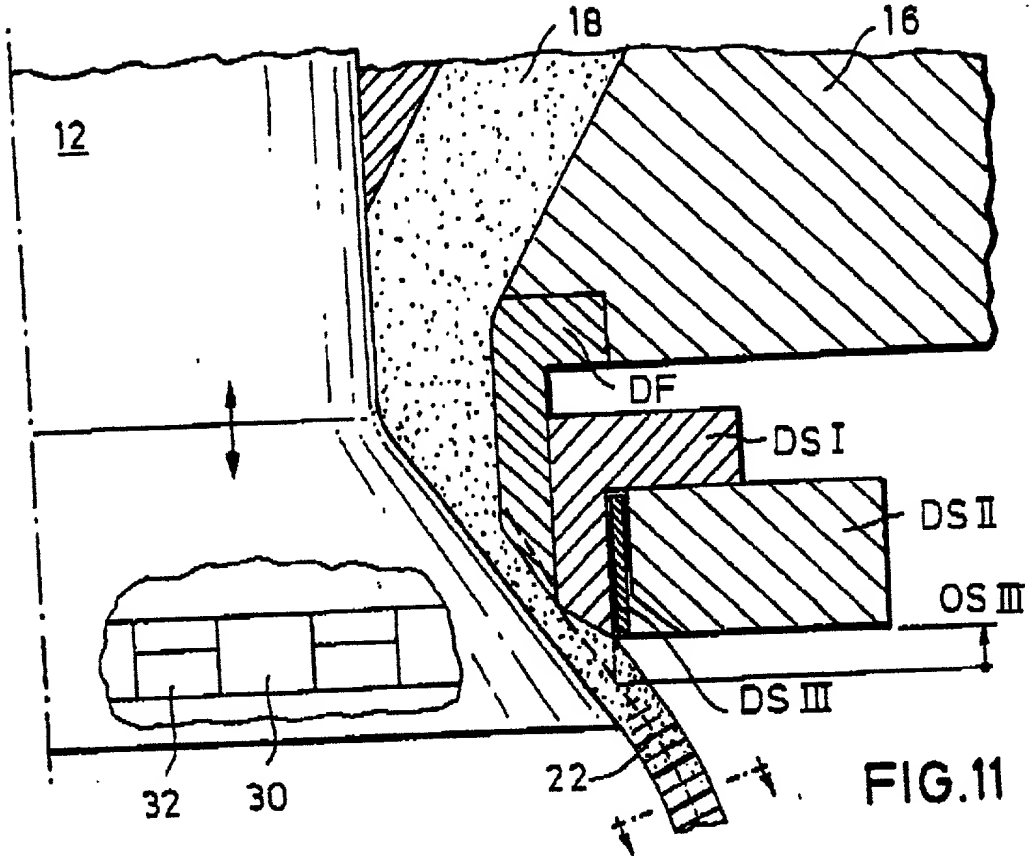


FIG.11

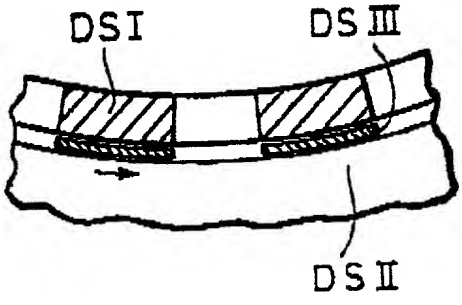


FIG.11a

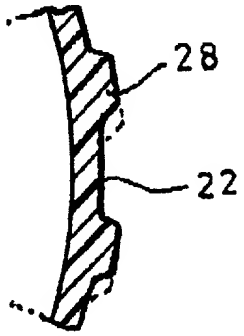


FIG.11b

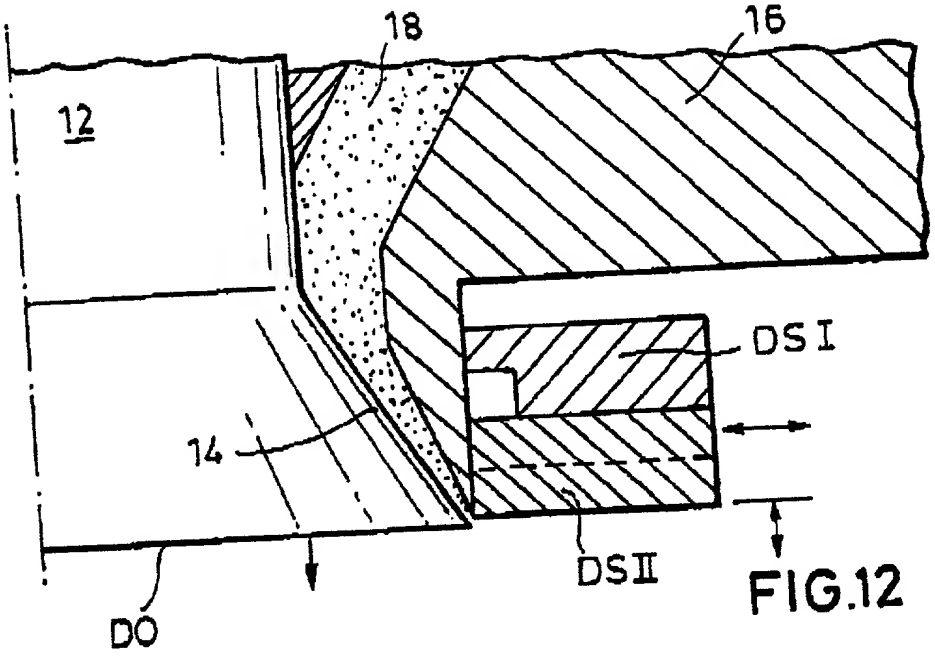


FIG.12

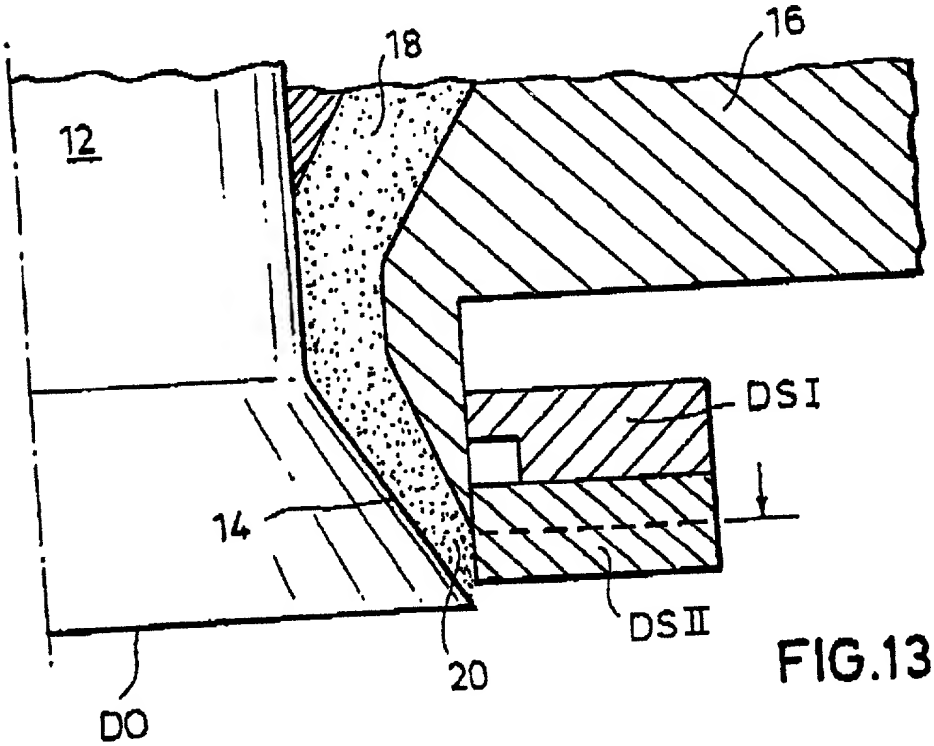


FIG.13

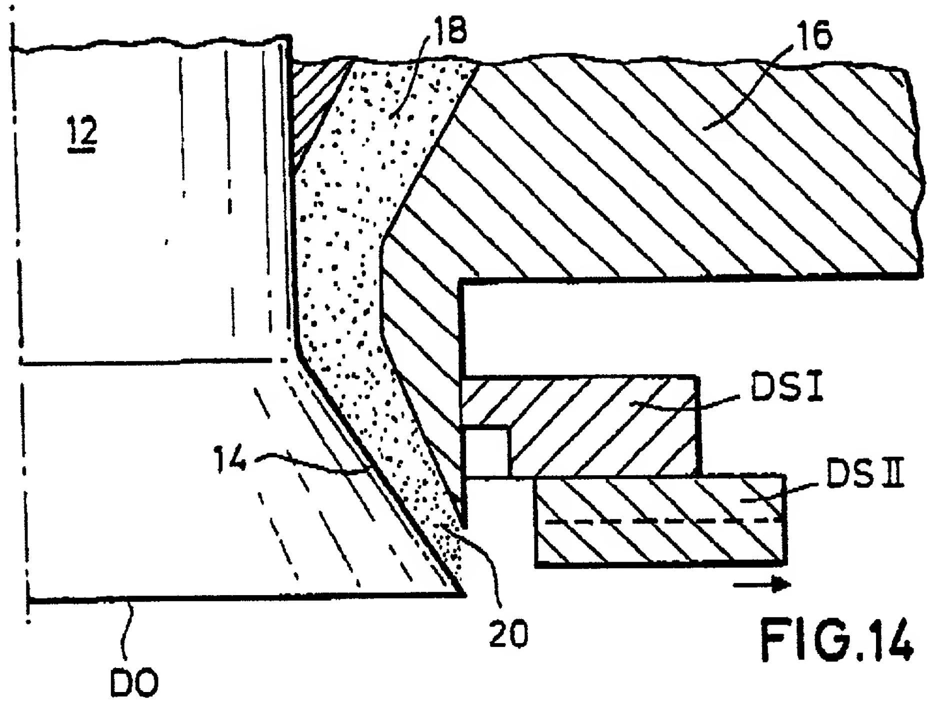


FIG.14

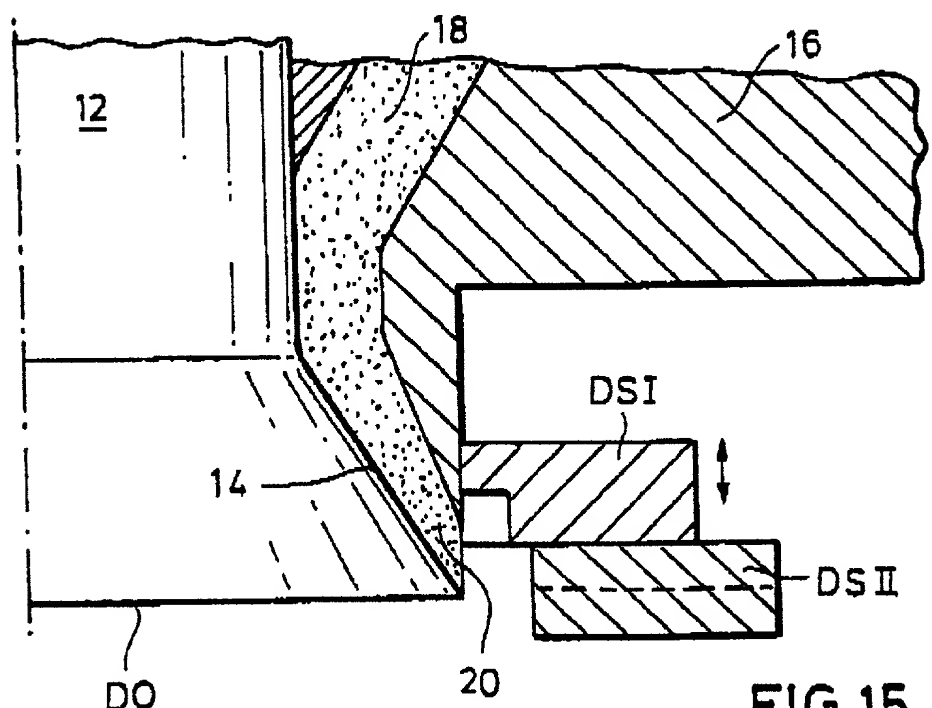


FIG.15

FIG.17

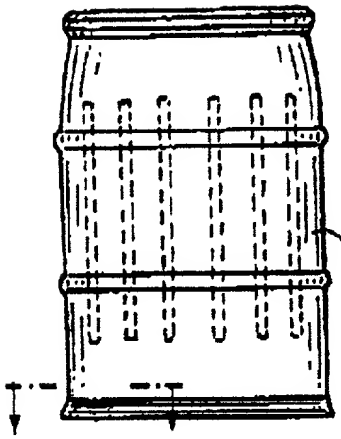
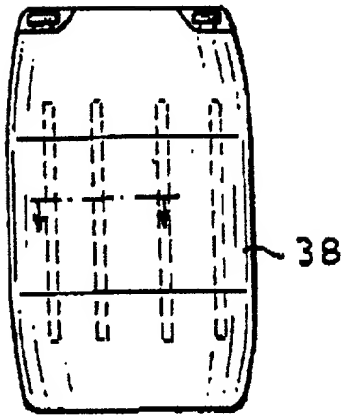


FIG.16



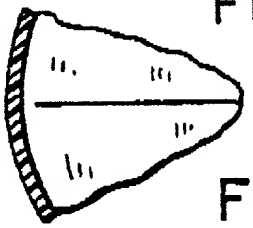


FIG.16a

FIG.17a

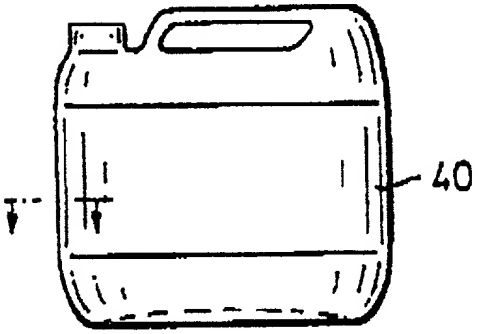


FIG.18

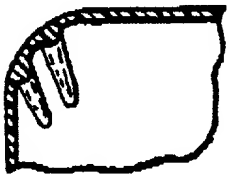


FIG.18a

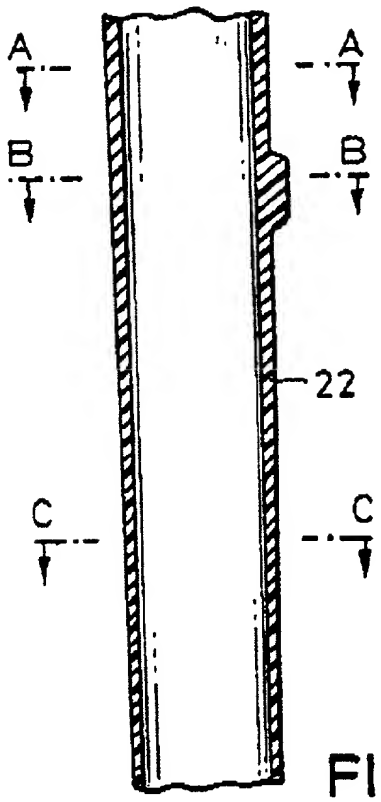


FIG.19

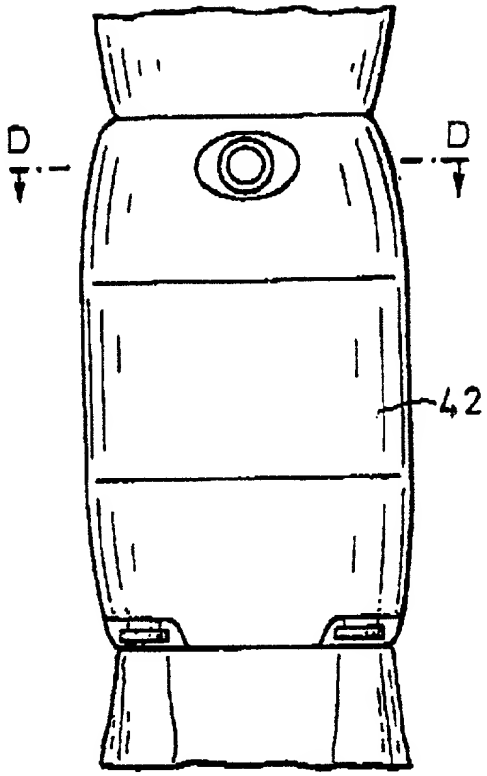


FIG.20

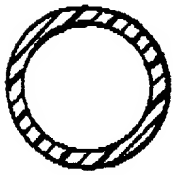


FIG.19a

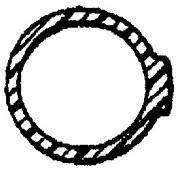


FIG.19b

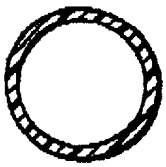


FIG.19c

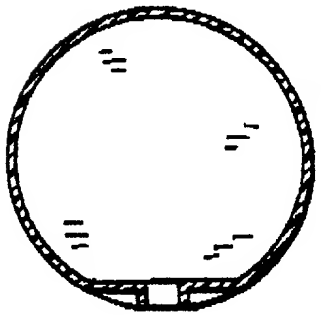


FIG.20a

P 02/99 PCT-US

Declaration and Power of Attorney for Patent Application
Erklärung für Patentanmeldungen mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

daß mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

daß ich, nach bestem Wissen, der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

EXTRUSIONSKOPF

deren Beschreibung
(zutreffendes ankreuzen)

[ ] hier beigefügt ist.
[X] wurde angemeldet am 4 März 1999 unter der U.S.-Anmeldungs Nr. oder unter der internationalen Anmeldenummer im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) PCT/EP99/01386 und am _____ abgeändert (falls zutreffend).

Ich bestätige hiermit, daß ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag, wie oben erwähnt, abgeändert wurde.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen an, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Titel 37, Code of Federal Regulations, §1.56 von Belang sind.

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Titel 35, US-Code, §119(a)-(d), bzw. §365(b) aller unten angegebenen Auslandsanmeldungen für ein Patent oder Erfinderurkunden, oder §365(a) aller PCT internationalen Anmeldungen, welche wenigstens ein Land ausser den Vereinigten Staaten von Amerika benennen, und habe nachstehend durch ankreuzen sämtliche Auslandsanmeldungen für Patents oder Erfinderurkunden oder PCT internationale Anmeldungen angegeben, deren Anmeldetag dem der Anmeldung, für welche Priorität beansprucht wird, vorangeht.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

EXTRUSION HEAD

the specification of which
(check one)

[X] is attached hereto
[ ] was filed on 4 March 1999 as United States Application Number or PCT International Application Number PCT/EP99/01386 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Applications
(Frühere ausländische Anmeldungen)

Priority Claimed?
Priorität beansprucht?

298 03 780.7 (Number) (Nummer)	Germany (Country) (Land)	5/March/1998 (Day/Month/Year Filed) (Tag/Monat/Jahr eingereicht)	[X] Yes Ja	[ ] No Nein
(Number) (Nummer)	(Country) (Land)	(Day/Month/Year Filed) (Tag/Monat/Jahr eingereicht)	[ ] Yes Ja	[ ] No Nein

Ich beanspruche hiermit gemäss Titel 35, US-Code, §119(e), den Vorzug aller unten aufgeführten US-Hilfsanmeldungen

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) below

(Application No. / Anmeldenr.) (Filing Date / Anmeldedatum)

(Application No. / Anmeldenr.) (Filing Date / Anmeldedatum)

Ich beanspruche hiermit gemäss Titel 35, US-Code, §120, den Vorzug aller unten aufgeführten US-Patentanmeldungen bzw. §365(c) aller PCT internationalen Anmeldungen, welche die Vereinigten Staaten von Amerika benennen, und erkenne, insofern der Gegenstand eines jeden früheren Anspruchs dieser Patentanmeldung, bzw. PCT internationalen Anmeldung in einer gemäß dem ersten Absatz von Titel 35, US-Code §112 vorgeschriebenen Art und Weise offenbart wurde, meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Titel 37, Code of Federal Regulations, §1.56 von Belang sind und im Zeitraum zwischen dem Anmeldedatum der früheren Patentanmeldung und dem nationalen oder im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) gültigen internationalen Anmeldedatum bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(Appl. No.) (Anmeldenr.)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig aufgegeben)	(Status) (patented, pending abandoned)
(Appl. No.) (Anmeldenr.)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig aufgegeben)	(Status) (patented, pending abandoned)

Ich erkläre hiermit, daß alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und daß ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, daß wissentlich und vorsätzlich falsche Angaben gemäss §. 1001, Titel 18 US-Code strafbar sind und mit Geldstrafe und/oder Gefängnis bestraft werden können, und daß derartig wissentlich und vorsätzlich falsche Angaben die Rechtswirksamkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

HENRY M. FEIEREISEN
Reg. No. 21,084

Telefongespräche bitte richten an:
(Name und Telefonnummer)

Direct telephone calls to:
(Name and telephone number)

HENRY M. FEIEREISEN
(212) 244-5500

Postanschrift:

Send Correspondence to:

020151

PATENT 006111 MARK OFFICE

Voller Name des einzigen oder ursprünglichen Erfinders

Full name of first inventor

DIETMAR PRZYTULLA

D. Przytulla — SEPT. 4 2000

Unterschrift des Erfinders — Datum — Inventor's Signature — Date

Wohnsitz

Residence

Kerpen / Germany DEX

Staatsangehörigkeit

Citizenship

Germany

Postanschrift

Post Office Address

Gustav-Heinemann-Strasse 54
50171 Kerpen
Germany

Voller Name des zweiten Erfinders

Full name of second inventor

PETER LANGOS

P. Langos — SEPT. 4. 2000

Unterschrift des Erfinders — Datum — Inventor's Signature — Date

Wohnsitz

Residence

St. Augustin / Germany DEX

Staatsangehörigkeit

Citizenship

Germany

Postanschrift

Post Office Address

Im Wehrfeld 22
53757 St. Augustin
Germany